APPENDIX K

PRELIMINARY RISK ASSESSMENT

Technical Memorandum

From: Paul F. Goetchius, DVM

To: Former Washrack, Building 1740, Soldier's Chapel (Parcel 127[7]), Fort McClellan, Calhoun County, Alabama
Preliminary Risk Assessment File

Date: 10 June 2002

Subject: **PRELIMINARY RISK ASSESSMENT FOR SUBJECT SITE**

This memorandum provides a Preliminary Risk Assessment (PRA) for the Former Washrack, Building 1740, Soldier's Chapel, collectively known and herein referred to as Parcel 127(7). Parcel 127(7) is located off Halifax Avenue on the central portion of the Main Post. Building 1740 (Soldier's Chapel) is located near the central portion of the parcel and faces Halifax Avenue. A paved driveway is located north and parking area is located east of Building 1740. Trees cover the northern portion of the parcel while grass covers the southern portion. A small building and a concrete pad, which appears to be the foundation of a former smaller building, are located behind Building 1740. Immediately adjacent to the southeast corner of Building 1740 is a large rectangular metal cover over an underground concrete grease trap. This grease trap appears to connect to the Building 1740 sewer system.

Six washracks and a grease pit are located approximately 20 feet to the northeast of Building 1740. This facility was used for vehicle maintenance during the 1950s and 1960s. The washracks measure approximately 73.5 feet by 20.5 feet in total length and width and each rack measures approximately 12.5 feet by 20.5 feet. A large sump is located in the center of each individual washrack unit. The grease pit appears to be approximately 25 feet by 30 feet by 6 to 8 feet deep, although dense overgrowth with bushes and trees precluded accurate measurement. The grease pit appeared to have about 1 foot of standing water during a site visit in June 1998. Observations made after the June 1998 site visit revealed the grease pit to be dry at times. Terra cotta tile drains reportedly discharge north of the washracks, but these drains or drains in the bottom of the grease pit were not observed during the site visit.

Parcel 127(7) is approximately 810 feet above mean sea level and is relatively flat. However, the eastern portion of the parcel has a slight slope to the northeast. The washracks and grease pit are located upgradient of a surface drainage feature that transects the northeastern portion of the site.

The purpose of the PRA is to support a recommendation for no further action and unrestricted site use proposed by the Supplemental Site Investigation (SSI). The PRA approach is a shortened version of the Streamlined Risk Assessment (SRA) protocol developed as a uniform and economical approach to evaluating hundreds of similar sites at Fort McClellan (FTMC). It is assumed that the reader is familiar with FTMC and the fundamentals of the SRA protocol. The reader is referred to the Installation-Wide Work Plan (IT, 2002) for more detail. All the comparison and computational operations of the PRA are performed within EXCEL® spread sheet tables. The PRA was performed in two iterations – a first iteration, and a refined assessment to more precisely evaluate the potential for noncancer effects, as explained below.

The results of each step are described below.

Media of Interest and Data Selection. Media of interest on Parcel 127(7) include surface and depositional soil, subsurface soil and groundwater. Surface water is not consistently present on the site, and significant contact with this medium is unlikely. Therefore, surface water is not included in the PRA. Also, an interim removal action for soil was performed in November 2001 because of contamination revealed by former sampling events. It is assumed that potential contaminants remaining in soil are present at concentrations comparable to background or at levels below their site-specific screening levels (SSSL), obviating the need to further evaluate soil in this PRA. Therefore, groundwater remains the only medium requiring evaluation herein. Groundwater is evaluated as if it were developed as a source of potable water.

The available groundwater data include 16 samples from nine monitoring wells taken from January 1999 to April 2002. All samples were analyzed for volatile organic compounds (VOC). Three of the samples, taken in January and February 1999, were also analyzed for metals and semivolatile organic compounds (SVOC). The analytical results are presented in the SSI (Table 5-3). All the analytical data were third-party validated. Analytical data for organic chemicals that were "B" qualified, indicating that one or more blanks were contaminated, were not used in the PRA. Also, Sample KRR3009 taken 5 March 2002 from MW01 was not included because it was believed to be cross-contaminated as explained in Section 5.3 of the SSI. A total of 15 samples were evaluated in the PRA.

Site-Related Chemical Selection. Site-related chemicals are those presumed to be released by the army during operation of FTMC. Site-related chemicals were selected by comparing the maximum detected concentration (MDC) of each chemical with its background screening criterion (BSC), computed as two times the mean of the background data set, consistent with EPA (2002) Region IV guidance. BSCs were taken from IT (2000). Chemicals whose MDCs exceeded their BSCs were selected as site-related chemicals and were subjected to chemical of potential concern (COPC) selection (described below) for inclusion in the first iteration of the PRA.

The site-related chemicals chosen in this manner are identified in Tables 1 and 2. Site-related chemicals in groundwater include all but a few of the metals, and the five VOCs that were detected sporadically in seven of the 15 samples.

Upper tolerance limits (UTL), the highest metal concentrations reasonably considered to be within background, are also included in Tables 1 and 2 for information, but were not used to select site-related chemicals for the first iteration of the PRA. The UTL provides a more refined statistical approach than the BSC for comparing site and background data.

Receptor Scenario Selection. According to the FTMC land reuse plan, Parcel 127(7) is located in an area slated for development for mixed business. Lacking more specific information, it is reasonable to select the groundskeeper as the most plausible receptor for this proposed site reuse. The groundskeeper represents the upper bound on long-term exposure under an occupational exposure scenario. The construction worker scenario is also plausible, but the groundskeeper evaluation represents the more conservative evaluation for exposure to groundwater. Therefore, the construction worker scenario is not quantified. An on-site resident

is included in the evaluation, although development for residential use is unlikely, to provide additional perspective. Also, sites that "pass" a residential risk evaluation generally can be released for unrestricted use with no further action.

Chemical of Potential Concern Selection. COPCs are site-related chemicals whose MDCs exceed their SSSLs, and which may contribute significantly to risk. The SSSLs are receptor-, medium-, and chemical-specific risk-based concentrations that capture all the exposure assumptions and toxicity assessment of a full-blown baseline risk assessment. COPCs were selected for both cancer risk and noncancer effects when the data were sufficient (Tables 1 and 2). COPCs in groundwater are limited to metals and two VOCs (carbon tetrachloride and chloroform).

Risk Characterization. Risk characterization combines the exposure assumptions and toxicity assessment (incorporated in the SSSLs) with the exposure-point concentration (EPC) to quantify the incremental lifetime cancer risk (ILCR) and noncancer hazard index (HI). ILCR and HI estimates are computed for each COPC in each medium, and are summed across COPCs and media to yield a total ILCR and total HI for each receptor scenario. The PRA differs from an SRA in that ordinarily no attempt is made to estimate an EPC that reflects a conservative estimate of average concentration for use in risk assessment, at least not in the first iteration. Instead, the MDC is adopted as the EPC, which imparts a conservative bias to the first iteration.

EPA (1990) considers ILCR estimates below 1E-6 to be negligible, ILCR estimates from 1E-6 to 1E-4 to fall within a risk management range, and ILCR estimates above 1E-4 to be generally unacceptable. EPA (1989) considers HI values below the threshold level of 1 to indicate that the occurrence of adverse noncancer health effects is unlikely. Summing HI values across chemicals, however, is considered to impart a conservative bias to the assessment because only those chemicals that share a mechanism of toxicity are likely to interact in an additive manner. Since data regarding mechanism of toxicity are generally insufficient, target organ or critical effect is used as a surrogate. In other words, chemicals that act upon the same target organ or that have the same critical effect are considered to act by the same mechanism of toxicity. Therefore, when HI values summed across chemicals and media exceed the threshold level of 1, the HI values may be re-summed by target organ to refine the assessment.

Risk estimates may be rounded to one significant figure to reflect the uncertainty about their computation (EPA, 1989, 2002). For example, a calculated ILCR of 9.50E-7 would be rounded to 1E-6 and interpreted as falling within the risk management range. Similarly, a calculated ILCR of 1.49E-4 would be rounded to 1E-4 and interpreted as falling within, but not exceeding, the risk management range. Also, an HI of 1.49E+0 would be rounded to 1 and interpreted as not exceeding the threshold level of 1. Risk estimates in this document are presented in scientific notation with two places to the right of the decimal to facilitate checking calculations. Rounding is done only if needed to simplify interpretation.

The groundskeeper was evaluated for exposure to groundwater (Table 1). COPCs selected for the groundskeeper include the metals aluminum, chromium, iron and lead, and the VOC carbon tetrachloride. The total ILCR of 4.75E-6 is within the risk management range. The total HI of 1.83E+0 exceeds the threshold level of 1.

A second iteration of the PRA was performed for the groundskeeper exposed to groundwater because the total HI exceeds the threshold level of 1. Chemicals of concern (COC) for groundwater included aluminum, chromium, iron, lead and carbon tetrachloride (Table 1). As noted above, only three samples were analyzed for metals. Apparently the samples analyzed for metals were compromised by the presence of high levels of sediment, as evidenced by turbidity readings of 30, 46 and 1000 nephelometric turbidity units (NTU). Generally, highest metal concentrations were identified in Sample KR3003 with the turbidity reading of 1000 NTU. The second iteration consisted of deleting data from Sample KR3003 from the data set, because data from this sample are not suitable for use in the risk assessment.

The resulting MDCs from the censored data set for the metal COCs are:

Aluminum	2.83E+0 mg/L
Chromium	7.00E-3 mg/L
Iron	5.58E+0 mg/L
Lead	5.30E-3 mg/L

The MDCs of iron and lead now fall below their BSCs, and the MDCs of aluminum and chromium fall below their respective UTLs. It is concluded that the metals are present at concentrations comparable to background. Therefore, the metals are deleted from the groundskeeper evaluation, and the total HI for the second iteration is 1.46E-1 associated solely with carbon tetrachloride. The total HI is below the threshold level of 1. It is concluded that exposure to groundwater does not represent a health threat to the groundskeeper.

The on-site resident was included in the PRA for the additional information and perspective provided by evaluation of the most highly exposed receptor, although residential development is not included in the plans for this site. Should the residential scenario "pass" the PRA, the site can be released for unrestricted use with no further action.

The on-site resident was evaluated for exposure to groundwater (Table 2). COPCs selected for residential exposure to groundwater include several metals (aluminum, barium, beryllium, chromium, iron, lead, nickel, vanadium and zinc) and two VOCs (carbon tetrachloride, chloroform). The total ILCR of 2.44E-5, due entirely to the VOCs, falls within the risk management range. The total HI of 1.35E+1 exceeds the threshold value of 1.

A second iteration of the PRA was performed for the on-site resident exposed to groundwater because the total HI exceeds the threshold level of 1. COCs for groundwater include aluminum, barium, beryllium, chromium, iron, lead, nickel, vanadium, zinc, carbon tetrachloride and chloroform (Table 2). The second iteration included deleting data from Sample KR3003 as described above. The resulting MDCs from the censored data set for the metal COCs are:

Aluminum	2.83E+0 mg/L
Barium	1.03E-1 mg/L
Beryllium	Not detected
Chromium	7.00E-3 mg/L
Iron	5.58E+0 mg/L
Lead	5.30E-3 mg/L
Nickel	2.78E-2 mg/L
Vanadium	1.15E-2 mg/L
Zinc	4.94E-1 mg/L

The MDCs of barium, beryllium, iron, lead and vanadium now fall below their BSCs, and the MDCs of aluminum, chromium, nickel and zinc now fall below their respective UTLs. It is concluded that all the metal COCs are present at concentrations comparable to background. Therefore, the metals are deleted from the residential evaluation, and the total HI for the second iteration is 1.41E+0, due entirely to the two VOCs.

The second iteration total HI of 1.41E+0 for residential exposure to groundwater, when rounded to one significant figure, is equivalent to the threshold level of 1.

Detections of chloroform and carbon tetrachloride used in the PRA (ignoring three "B" qualified detections of chloroform) are summarized below:

Sample Location	Sample Number	Sample Date	Chloroform (mg/L)	Carbon Tetrachloride (mg/L)
GPO1	KR3001	1/29/99	"B"	ND
GP02	KR3002	2/1/99	"B"	9.40E-3
GP03	KR3003	2/4/99	"B"	ND
MW01	KRR3001	11/2/00	ND	ND
MW01	KRR3001R	4/8/02	ND	ND
MW02	KRR3002	11/2/00	ND	2.70E-3 "J"
MW02	CSM3008	2/21/02	8.70E-4 "J"	3.30E-3
MW03	KRR3003	12/18/00	ND	ND
MW03	KRR3012	3/8/02	ND	ND
MW04	KRR3006	11/7/00	ND	ND
MW04	KRR3013	3/7/02	ND	ND

Sample Location	Sample Number	Sample Date	Chloroform (mg/L)	Carbon Tetrachloride (mg/L)
MW05	KRR3007	12/19/00	ND	ND
MW05	KRR3014	3/6/02	ND	ND
MW06	KRR3008	1/15/01	1.60E-3 "J"	2.20E-3 "J"
MW06	CSM3009	2/25/02	1.10E-3	6.10E-4 "J"

ND = not detected. Capital letters in quotation marks are data validation qualifier codes.

Chloroform was identified in three samples from two separate monitoring wells at concentrations ranging from 8.70E-4 to 1.60E-3 milligrams per liter (mg/L). It should be noted that the MDC of 1.60E-3 mg/L is below the EPA (2000) maximum contaminant level (MCL) of 8E-2 mg/L for total trihalomethanes. Carbon tetrachloride was identified in five samples from three separate monitoring wells at concentrations ranging from 6.10E-4 to 9.40E-3 mg/L. The MDC from GP02 slightly exceeds the MCL of 5E-3 mg/L.

The foregoing evaluation is based on adopting the MDCs of chloroform and carbon tetrachloride as the respective EPCs. The sample data summarized above, however, suggest that both chemicals are distributed in definable confluent plumes. EPA (2002) suggests that the EPC for a groundwater contaminant should be estimated as the arithmetic mean of the most highly contaminated part of the plume, when the plume is definable. This recommendation can be applied to these data by calculating the arithmetic mean of the detected concentrations of chloroform and carbon tetrachloride. The arithmetic mean concentrations of chloroform (1.19E-3 mg/L) and carbon tetrachloride (3.64E-3 mg/L) are adopted as more reasonable EPC estimates for exposure to these chemicals. HI values calculated from the new EPCs include 3.82E-1 for chloroform and 3.46E-1 for carbon tetrachloride, yielding a total HI of 7.28E-1, clearly below the threshold level of 1. Also, the more reasonable EPC for carbon tetrachloride falls below the MCL of 5E-3 mg/L.

In summary, 15 samples identify metals and VOCs in groundwater at Parcel 127(7). The metals appear to be present at concentrations comparable to background and are dropped from the second iteration of the PRA. Chloroform and carbon tetrachloride are the only COCs in groundwater. The total HI for residential exposure to groundwater, when rounded to one significant figure, is equivalent to the threshold level of 1 when the MDC is adopted as the EPC for both COCs. No chloroform detections exceeded the MCL for this compound. One carbon, tetrachloride, detection slightly exceeds the MCL for this compound, but the more reasonable EPC based on the arithmetic mean falls below the MCL. It is concluded that groundwater at Parcel 127(7) developed as a source of potable water is unlikely to cause adverse health effects in human receptors.

References

IT Corporation (IT), 2000, ***Human Health and Ecological Screening Values and PAH Background Summary Report***, Final, Fort McClellan, Calhoun County, Alabama, Prepared for U.S. Army Corps of Engineers, Mobile District, August.

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U.S. Environmental Protection Agency (EPA), 1989, ***Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A)***, Interim Final, Office of Emergency and Remedial Response, Washington, DC, EPA/540/1-89/002, December.

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U.S. Environmental Protection Agency (EPA), 2000, ***Drinking Water Standards and Health Advisories***, Office of Water, Washington, DC, EPA 822-B-00-001, Summer.

U.S. Environmental Protection Agency (EPA), 2002, ***Region 4 Human Health Risk Assessment Bulletins – Supplement to RAGS, Interim Human Health Risk Assessment Bulletins***, Waste Management Division, EPA Region 4, Atlanta, GA, on line.

Table 1

Preliminary Risk Assessment for the Groundskeeper Exposure to Groundwater
Former Washrack, Building 1740, Soldier's Chapel, Parcel 127(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Groundskeeper Groundwater SSSL-c[b]	Groundskeeper Groundwater SSSL-n[c]	Groundskeeper Cancer COPC?[d]	Groundskeeper Noncancer COPC?[e]	Groundskeeper ILCR[f]	Groundskeeper HI[g]
METALS										
Aluminum	2.16E+01	2.34E+00	5.95E+00	2.16E+01	NA	1.01E+01		2.16E+01		2.15E-01
Arsenic	1.68E-02	1.78E-02	1.17E-01		1.90E-04	3.05E-03				
Barium	3.88E-01	1.27E-01	4.72E-01	3.88E-01	NA	7.12E-01				
Beryllium	3.90E-03	1.25E-03	5.00E-03	3.90E-03	NA	1.45E-02				
Calcium	6.05E+01	5.65E+01	7.14E+01	6.05E+01	NA	NA				
Chromium[h]	4.32E-02	NA	1.68E-02	4.32E-02	NA	2.83E-02		4.32E-02		1.52E-01
Cobalt	1.82E-02	2.34E-02	2.02E-02		NA	6.08E-01				
Copper	2.96E-02	2.55E-02	2.07E-01	2.96E-02	NA	4.06E-01				
Iron	4.03E+01	7.04E+00	2.20E+01	4.03E+01	NA	3.05E+00		4.03E+01		1.32E+00
Lead	1.88E-02	8.00E-03	4.34E-02	1.88E-02	NA	1.50E-02		1.88E-02		
Magnesium	1.23E+01	2.13E+01	2.20E+01		NA	NA				
Manganese	5.61E-01	5.81E-01	4.13E+00		NA	4.44E-01				
Mercury	1.30E-04	NA	2.43E-04	1.30E-04	NA	2.90E-03				
Nickel	6.35E-02	NA	3.43E-02	6.35E-02	NA	2.02E-01				
Potassium	3.91E+00	7.20E+00	1.60E+01		NA	NA				
Sodium	6.23E+00	1.48E+01	4.90E+01		NA	NA				
Vanadium	4.46E-02	1.70E-02	2.76E-02	4.46E-02	NA	5.94E-02				
Zinc	4.94E-01	2.20E-01	1.16E+00	4.94E-01	NA	3.04E+00				
VOLATILE ORGANIC COMPOUNDS										
Acetone	1.20E-02	NA		1.20E-02	NA	1.02E+00				
Carbon tetrachloride	9.40E-03	NA		9.40E-03	1.98E-03	6.43E-03	9.40E-03	9.40E-03	4.75E-06	1.46E-01
Chloroform	1.60E-03	NA		1.60E-03	4.53E-02	9.86E-02				
Chloromethane	2.40E-04	NA		2.40E-04	2.16E-02	4.02E-02				
cis-1,2-Dichloroethene	3.30E-04	NA		3.30E-04	NA	9.91E-02				
Total ILCR, HI									**4.75E-06**	**1.83E+00**

All concentrations expressed as mg/L.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
-- = No ILCR or HI calculated.
NA = Not Available.

[a] MDC presented only if it exceeds BSC, or no BSC is available.

[b] Site-specific screening level (SSSL) based on cancer risk for the groundskeeper exposure to groundwater.

[c] Site-specific screening level based on noncancer hazard for the groundskeeper exposure to groundwater.

[d] MDC presented only if it exceeds SSSL-c.

[e] MDC presented only if it exceeds SSSL-n.

[f] Incremental lifetime cancer risk for the groundskeeper exposed to chemical in groundwater.

[g] Hazard index for noncancer effects for the groundskeeper exposed to chemical in groundwater.

[h] SSSL based on chromium VI.

Table 2

Preliminary Risk Assessment for the Resident Exposure to Groundwater
Former Washrack, Building 1740, Soldier's Chapel, Parcel 127(7)
Fort McClellan, Calhoun County, Alabama

Chemical	MDC	BSC	UTL	Site-Related Chemical?[a]	Resident Groundwater SSSL-c[b]	Resident Groundwater SSSL-n[c]	Resident Cancer COPC?[d]	Resident Noncancer COPC?[e]	Resident ILCR[f]	Resident HI[g]
METALS										
Aluminum	2.16E+01	2.34E+00	5.95E+00	2.16E+01	NA	1.56E+00		2.16E+01		1.38E+00
Arsenic	1.68E-02	1.78E-02	1.17E-01		4.46E-05	4.69E-04				
Barium	3.88E-01	1.27E-01	4.72E-01	3.88E-01	NA	1.10E-01		3.88E-01		3.54E-01
Beryllium	3.90E-03	1.25E-03	5.00E-03	3.90E-03	NA	3.13E-03		3.90E-03		1.25E-01
Calcium	6.05E+01	5.65E+01	7.14E+01	6.05E+01	NA	NA				
Chromium[h]	4.32E-02	NA	1.68E-02	4.32E-02	NA	4.69E-03		4.32E-02		9.21E-01
Cobalt	1.82E-02	2.34E-02	2.02E-02		NA	9.39E-02				
Copper	2.96E-02	2.55E-02	2.07E-01	2.96E-02	NA	6.26E-02				
Iron	4.03E+01	7.04E+00	2.20E+01	4.03E+01	NA	4.69E-01		4.03E+01		8.59E+00
Lead	1.88E-02	8.00E-03	4.34E-02	1.88E-02	NA	1.50E-02		1.88E-02		
Magnesium	1.23E+01	2.13E+01	2.20E+01		NA	NA				
Manganese	5.61E-01	5.81E-01	4.13E+00		NA	7.35E-02				
Mercury	1.30E-04	NA	2.43E-04	1.30E-04	NA	4.69E-04				
Nickel	6.35E-02	NA	3.43E-02	6.35E-02	NA	3.13E-02		6.35E-02		2.03E-01
Potassium	3.91E+00	7.20E+00	1.60E+01		NA	NA				
Sodium	6.23E+00	1.48E+01	4.90E+01		NA	NA				
Vanadium	4.46E-02	1.70E-02	2.76E-02	4.46E-02	NA	1.10E-02		4.46E-02		4.07E-01
Zinc	4.94E-01	2.20E-01	1.16E+00	4.94E-01	NA	4.69E-01		4.94E-01		1.05E-01
VOLATILE ORGANIC COMPOUNDS										
Acetone	1.20E-02	NA		1.20E-02	NA	1.56E-01				
Carbon tetrachloride	9.40E-03	NA		9.40E-03	4.08E-04	1.05E-03	9.40E-03	9.40E-03	2.30E-05	8.93E-01
Chloroform	1.60E-03	NA		1.60E-03	1.15E-03	3.11E-04	1.60E-03	1.60E-03	1.39E-06	5.14E-01
Chloromethane	2.40E-04	NA		2.40E-04	3.93E-03	6.22E-03				
cis-1,2-Dichloroethene	3.30E-04	NA		3.30E-04	NA	1.55E-02				
Total ILCR, HI									**2.44E-05**	**1.35E+01**

All concentrations expressed as mg/L.
MDC = maximum detected concentration; BSC = background screening criterion; UTL = 95% Upper Tolerance Limit.
-- = No ILCR or HI calculated.
NA = Not Available.

[a] MDC presented only if it exceeds BSC, or no BSC is available.

[b] Site-specific screening level (SSSL) based on cancer risk for the resident exposure to groundwater.

[c] Site-specific screening level based on noncancer hazard for the resident exposure to groundwater.

[d] MDC presented only if it exceeds SSSL-c.

[e] MDC presented only if it exceeds SSSL-n.

[f] Incremental lifetime cancer risk for the resident exposed to chemical in groundwater.

[g] Hazard index for noncancer effects for the resident exposed to chemical in groundwater.

[h] SSSL based on chromium VI.